the very slight conformity of the testimony of widely separated sections contribute little or nothing to a demonstration which can be established or disproved probably only by a rigorous discussion of homogeneous material from a limited number of *long records*. Great importance attaches to the testimony of *long* records. Numerous stations or wide extent of territory can not make up for brevity in length of record. It is well known that warm and cold winters, for example, wet and dry seasons, in fact, all striking features of weather sequences, are not confined to single States but in general embrace very extended areas. The maps published by the Bureau for many years showing departures from normal often show in a striking way the widespread extent of marked anomalies in weather conditions. The presence of these anomalies give position and amplitude to the features in Mr. Alter's curves.

The concurrence of similar features in short records from numerous stations, or contiguous States even, are simply expressions of the similarity of weather conditions over the region in question. Even the semblance of similarity which Mr. Alter seems to believe marks the records for all the States of the United States has very little significance if based on relatively short records as is the actual case. We know from the control of the laws of chance that such similarities are inevitable, and nothing but the persistence of features in very long records suffices to establish the realty of alleged cycles which are so obscure and uncertain as the one which Mr. Alter claims is a possible case.

The occurrence of anomalies can be explained without resort to cosmical or extra-terrestrial causes. A very slight study of such questions long ago convinced the specialists of the Bureau that the cause of the major as also of many of the minor anomalies in question is practically always associated with varying features of the general circumpolar circulation of the atmosphere. It is true the full explanation of these seemingly fundamental connections can not be stated, and records suitable for critical investigation thereof are short and incomplete. In any case, it is irrational to claim or intimate that there is any significant relation between rainfall and sun-spots unless it is clearly demonstrated that the variations in the general circulation of the atmosphere which are known to modify greatly and to determine sequences of rainfall are themselves proven to be controlled by sun-spot conditions or intimately correlated thereto.

For these reasons little is added to a demonstration like Prof. Alter's by the great bulk of data discussed except possibly to fix somewhat more definitely very uncertain magnitudes inherent to short records. Only features which persistently stand out in *very long records*, even if such apply to only a limited area, are likely to be real.

The writer expects to present in a subsequent paper a number of fundamental propositions supported by graphic and mathematical criteria which may be employed to segregate abstractly in a convincing way cycles or sequences which are real from those which are specious or the result of fortuitous combinations.

METEOROLOGICAL COURSE GIVEN IN THE SIGNAL CORPS SCHOOL AT CAMP ALFRED VAIL, N. J., DURING 1920.

By HOMER W. BALL, Meteorologist.

[Weather Bureau, Royal Center, Ind., Feb. 10. 1921.]

[NOTE.—During the war, the first attempt at giving meteorological instruction consisted in training a few soldiers at the regular stations of the Weather Bureau. In the spring of 1918, the Signal Corps School of Meteorology was organized at the Texas Agricultural and Mechanical College, College Station, Tex. About half of these men and those who were first trained at the Weather Bureau stations were sent overseas; others were sent to camps in the United States where meteorological stations were established.[1] After the war, when the meteorological personnel of the war time had been largely discharged, to continue the meteorological work, it was necessary to instruct those men who were then enlisting in the Army. The present Signal Corps School was established at Camp Alfred Vail, N. J., about January 1, 1920, with the meteorological instruction in charge of Mr. Homer W. Ball, the author of this article. Mr. Ball continued in charge of this work until January 1, 1921, when it was taken over by Capt. A. H. Thiessen, formerly of the Weather Bureau. The school is continuing its work and at present has about 40 students.—EDITOR.]

SYNOPSIS.

The Army, recognizing the necessity of having men training in meteorological work, to supervise and carry on such work in the military service, has established a course in meteorology in the Signal Corps School at Camp Alfred Vail, N. J. As this is the only school in the United States giving a vocational course in meteorology, the results included in a considerable period of time may be watched with great interest. To date a large majority of the men who took this course in the school are doing excellent work on the Signal Corps stations.

The school maintained by the Signal Corps at Camp Alfred Vail, N. J., is for the theoretical and practical training of officers and enlisted men in the branches of work that pertain to that division of the military service. The theoretical work given to the enlisted men is necessarily elementary because of the short length of time allowed the student to finish his course and also the previous school training of a very large percentage of the men is not sufficient for them to do advanced studying. Considerable stress is laid upon the practical requirements so that the men taking the courses will be able to do the work assigned them along the lines in which they have had instruction. The instructional work is under the supervision of men who have had long experience in the duties covered by the subjects that they teach and the courses of study are arranged so that the conditions under which the student receives training will be as nearly as possible like those he will experience when on field duty or those under which he will have to work in civil life if he still wishes to follow the lines of instruction received in the school. Many men enlist in the Signal Corps to take advantage of the opportunities offered by the school and after their term of enlistment is ended they can then return to civil life and put to use the things they have learned while in the Army.

One of the departments established in the school at its beginning is meteorology. During the late war it was at once recognized that a large number of the activities of modern warfare depends upon atmospheric conditions on the surface of the earth and also at a considerable altitude above it. The Army having a large number of trained meterorologists has a great advantage over the one that does not have them. When the United States entered the conflict men trained in meteorological work and available for the Army were rather scarce and it was necessary to take a number of experts from the Weather Bureau to form a nucleus for a meteorological service in the Signal Corps. A large number of men were trained

[1] Regarding the Signal Corps School of Meteorology at College Station see MO. WEATHER REV., December, 1918, pp. 560-562; *also* ibid., April, 1919, pp. 215-222. Regarding the instruction in meteorology in France, see ibid., December, 1919, pp. 870-871.

and did excellent work, but at the close of the war they were almost all discharged and returned to their respective duties in civil life. Hence, in order to continue the meteorological work in the Army, it is imperative that men be trained now to meet the requirements of the military service.

The first class in meteorology at Camp Vail began its work January 5, 1920, with about one dozen enlisted men enrolled for the course. The educational qualifications of some of these men, and also of many of the others that entered the school later, were rather limited and, they having had no previous training in meteorological work, had very little conception of what was expected of them. It was therefore necessary to start at the beginning of the subjects and teach them the elementary principles of the work that they would be required to do. Considerable care was taken and a great amount of time was spent with each class to make each member realize that he must be conscientious and accurate in his work as the value of his efforts depends upon the getting of correct results. Each man is to a great extent on his own initiative when performing the actual duties of the stations instead of acting under the direct orders of a superior, as is usually the case in military work. After the students had completed the course or had become proficient in the work, they were sent to the meteorological stations of the Signal Corps located at the various Army posts in the United States. At those places the men were able to enter into the activities of their work at once because of the training they had received at the school. Some of the stations are at artillery proving grounds, where the men of the meteorological detachment are required to furnish ballistic wind data, wind direction, and velocity at various altitudes in addition to the reports of surface conditions several times daily. Data at other stations at aviation fields are obtained for the use of the aviator so that he may know what the atmospheric conditions are at the heights where he may wish to fly. The upper air data are obtained by means of pilot balloons observed through a theodolite on which the altitude and azimuth angles of the balloon's position each minute are read, with the zero of the azimuth scale on north. The height of the balloon, its angular direction from north, and the velocity of the wind that is carrying it along are computed from trigonometric relations or on a specially arranged plotting board. Records of surface conditions, similar to those kept by the Weather Bureau, are made at the various Signal Corps stations. Copies of the pilot balloon runs are furnished to the Weather Bureau to be used, together with its own aerological records, in connection with the forecast work or for any investigational purposes that may be desired by the scientists of that service.

During the first part of the year the length of the course in meteorology was six months and later was reduced to five months. Holidays and vacation periods usually subtracted two or three weeks from the allotted time. It was found that the work as outlined could be finished in five months if all the time each day during the school hours be taken up by recitations. Under those conditions the men were compelled to prepare their lesson when off duty, and the class record of each student was a good indication of the amount of time spent in this way. The school day was divided into five equal recitation periods. Beginning at 8 a. m. the surface observations were taken, reduced, and entered in the appropriate forms. This work occupied the first half of the first hour and the remainder of the period was given to the study of a meteorological textbook. The plan of the book was followed closely, with such modifications as were necessary to adapt it to the needs of the class, in order that the subject might be completed in the time allowed for the term. Brief statements as to the recent progress in meteorology were made occasionally by the instructor, and current literature on meteorology was made available to the students who wished to take advantage of the opportunity to do reading outside of the classroom. The weather map was of especial interest, and the relations of the weather conditions shown on the map to the daily forecast were watched very closely. The other periods were devoted in turn to elementary physics, elementary algebra, plane trigonometry, and pilot balloon work. Written examinations covering the week's work were required of the students Saturday forenoons. Elementary physics was considered principally to give the student a basis upon which to study meteorology. The algebra was given as a review to the students studying physics and plane trigonometry. The latter subject was considered with its special applications to pilot balloon work. Men having only a common-school education were given a review in arithmetic and also a short course in beginner's algebra.

The textbook work required of the advanced students was of the same grade as that of a high school. The methods of taking surface observations, reducing the data, making pilot balloon runs, and the necessary computations were similar to those employed by the Weather Bureau at present. A great amount of time was devoted to observational duties, teaching the students the principles of the work as they would be required to do it on the stations. Some of the men enrolled in the meteorological course were not able to carry all the work as outlined, due to the lack of previous school training. All the men, however, were required to do the same amount of practical and meteorological text work. In class the usual schoolroom methods were used. Each student had a textbook and was required to recite from a definite portion of the text, or from papers previously prepared by the instructor. Diplomas were given to the men who had taken the entire course and obtained a grade of 75 per cent or above. To those who failed to earn a passing mark in some of the subjects, certificates were given showing the actual amount of work done and the grade received in each subject. During the year 43 students took the course in meteorology; 17 of them were given diplomas and the remainder certificates. The need for trained men in the field was so great that some of the advanced students who so desired were sent to the stations to fill vacancies before they had completed their courses.

It was found that the men entered the school for one of three reasons. They were interested in the work and wanted to take advantage of the opportunities offered in the school, or they took the course out of curiosity as to what it was like, or they wished to become students to escape the duties given men who were not in the school. The men of the first class and also those of the second class, after they became interested, usually made good students. Those who entered the school for the first reason often had had their interest aroused by talking with the men already in the class or by watching them while they were doing their observational work out of doors. The pilot balloon work was of especial interest and was also rather mysterious to those who did not understand its significance. The actual performance of the work almost always increased the student's desire to continue and become proficient enough to do station duties. However, there were some that failed and most of the failures were, of course, among those of the third

class. They found that their company duties were easy compared to the efforts they would have to exert to obtain a passing grade in their school work. A number of these men had had very litttle, if any, high-school work and they hardly realized what it meant to exert themselves mentally. Men who had less than eighth-grade school work were not accepted as students, as the instructors did not have time to teach them the subjects that were necessary before they could enter the regular class in the meteorological course. Those who were high-school graduates or had had high-school training were preferred, although it was found that a few of the men with more limited school training made some of the best students. A few having some college training were enrolled in the class and they were often used as assistants to aid some of the other men who were slow in understanding the work.

Meteorology is a comparatively new subject as far as its broad applications to the Army are concerned, and this is perhaps the main reason that there was very little interest manifested in the meteorological course in the school at the beginning, except among the officers who are engaged in that branch of the work or among the few who understood the applications of meteorology to military duties. During the latter part of the year more interest was noticeable, due, no doubt, to the campaign of education carried on throughout the Army and also to the increasing number of men who had taken the course in the school and had been sent to the Signal Corps stations where they had interested others in meteorology. Several officers at the camp, after seeing what was being done and having the work explained to them, expressed a desire to enter the meteorological section as soon as an officer's course could be started. It is the aim of the Signal Corps to get as large a number in the school taking meteorology as the accommodations will permit in order that the graduates may man the new stations to be established and fill vacancies on those already in operation. Also arrangements are being made to start an officer's training course in the school as an extension of the work will require men of supervisory ability, and these men will be able to carry on the meteorological wo
Army, which then will not have to rely on other branches of the Government for properly trained men in times of emergency.

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SURFACE-AIR AND WATER TEMPERATURES AT WESTERN BANK OF GULF STREAM.

An example of the influence of ocean surface water temperature on that of the overlying air stratum is afforded by a series of air and water temperatures readings submitted to the Weather Bureau by Mr. H. T. Broere, formerly meteorological observer on the Dutch S. S. *Rotti*.

During a voyage of the *Rotti* from Colon to New York in March, 1919, Mr. Broere made a series of hourly readings of the air and water temperatures while the vessel was traveling in the Antilles branch of the equatorial current and the Gulf stream, and after passing from the latter into the cold waters of the Labrador current northeast of Cape Hatteras, the observations covering a period of some 80 hours.

The temperatures observed while the vessel was in the warm waters of the Gulf stream and when passing the "cold wall" are shown in figure 1, in which have been plotted the readings, both air and water, at intervals of

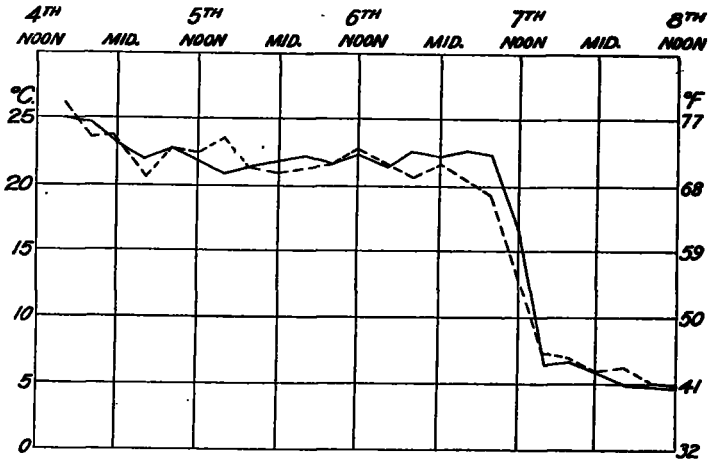

FIG. 1.—Temperatures of air and water observed by the *Rotti* when passing from the warm waters of the Gulfstream (dotted=air temperature; solid=water temperature.

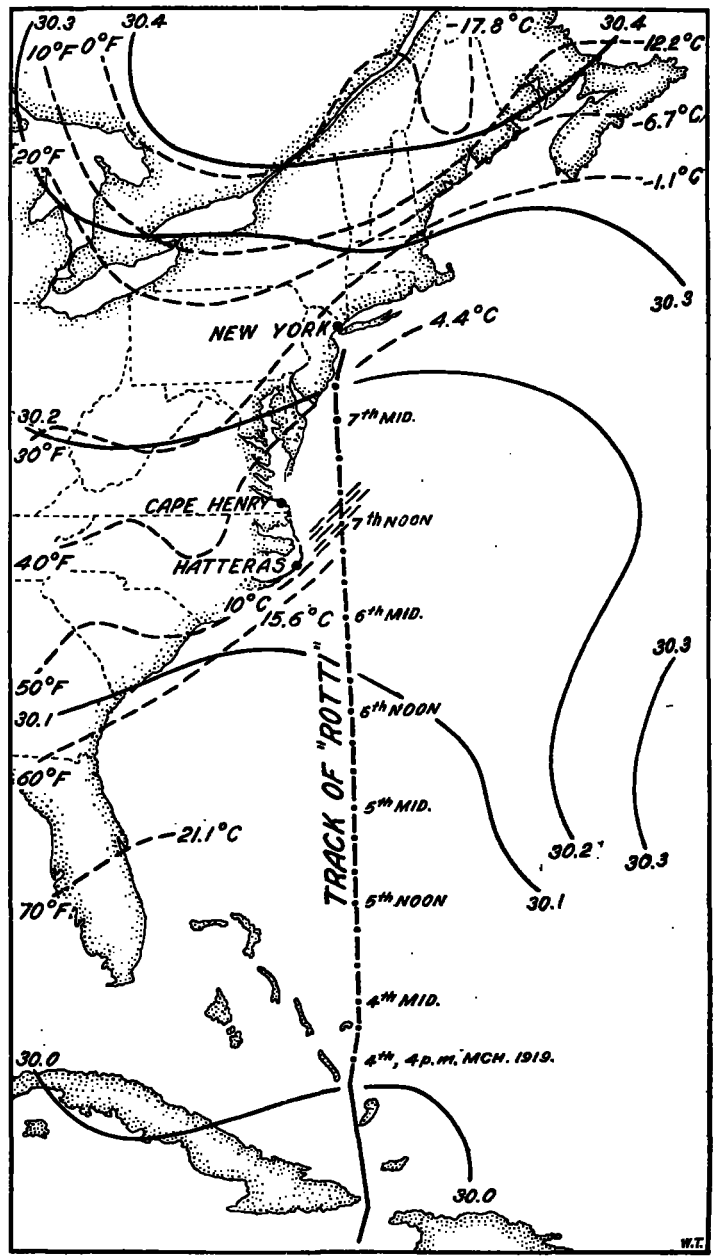

FIG. 2.—The track of the *Rotti* and the pressure and temperature conditions in eastern United States and Canada at 8 a. m. (75th mer. time), March 7, 1919.